



Maryland Center for Computing Education

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Director of Research and Assessment



Maryland Computing Education 15-Year Goals

	2017-18 1-2 Years	2019-2020 3-4 Years	2021-2026 5-10 Years	2027-2030 11-14 Years	2031 Final 15 Year Goals
Student Access and Participation	CS course listings and annual CS education event in every system. Gender, race, and socioeconomic gaps measured and targeted.	CS course offerings in every high school. AP-level course in 50% of high schools in each system.	CS course offerings, including AP, taught by trained teachers in every high school. Gaps have been reduced by 50% from baseline. CT integrated from preK-8 th grade.	Rigorous computing courses and content offered in every P-12 school.	CS is offered to every student throughout their P-12 education. Gaps have been reduced by 90% from baseline.
Professional Training	Trained teachers and professional school counselors in 50% of high schools.	At least one trained teacher in every public school, at least one trained professional school counselor in every public high school, and at least one trained professional school counselor in 50% of the public middle schools.	At least three undergraduate and three graduate programs offering CS certification.	Training universally available. All P-12 pre-service programs require a CS course.	All full-time secondary CS teachers are certified in CS. Offerings are continually updated.
Curriculum and Standards	P-12 CS framework and standards accepted in Maryland, consistent with national standards.	Curriculum materials identified for every grade level.	P-12 CS curriculum in every school system aligned with state CS standards.	Graduation requirements include CS. All P-12 CS standards implemented in all schools.	Review board established and in effect to continually update P-12 standards.

Adopted by the Maryland Computing Education Steering Committee in January 2016; revised and updated in January 2018.



Securing the Future: CS Education for All

- ❖ May 8, 2018: Governor signs into law.
- ❖ Formally recognizes the Maryland Center for Computing Education.
- ❖ Provides **\$7M over 3 years** in funding for MCCE to offer CS teacher professional development and seed grants for pre-service teacher education programs to include CS.
- ❖ Requires public high schools to offer high quality CS courses by the 2021-2022 school year.
- ❖ Requires school systems to make every effort to incorporate CS instruction in each public elementary and middle school.
- ❖ Explicitly calls for an increase in participation by students who live in areas of **high poverty or rural areas, females, students with disabilities, and students of ethnic, racial, or demographic groups that are underrepresented in computing.**



Maryland Center for Computing Education

Leadership	Guidance
Dr. Nancy Shapiro (USM) Dr. Carol Williamson (MSDE) DeWayne Morgan (USM) Advisory Committee	Dr. Jan Plane (UMD) Steering Committee
Budget, financial distribution, equitable distribution, implementation plan, grant processes	Assess statewide needs, recommend next steps, engage with stakeholders
Implementation	Research
Dianne O'Grady-Cunniff, Director	Dr. Megean Garvin, Director of Research and Assessment
District meetings, PD, teacher support, resource appraisal, national connections	Data, reports, publications, grant writing, assessment, monitor statewide policy changes



Publications

Garvin, M., Zarch, R., Xavier, J., & Dunton, S. (2020). Maximizing BPC Through Maryland's Annual State Summits . In Proceedings of RESPECT (Research on Equity and Sustained Participation in Engineering, Computing, and Technology). IEEE.

Garvin, M., Hendrickson, K., Dunton, S., Zinth, J., & Goldsmith, L. (In Press). Teacher-focused Policies to Broaden Participation in K–12 Computer Science Education. In Mouza, Yadav, & Leftwich (Eds.), *Preparing Teachers to Teach Computer Science: Models, Practices and Policies*. Charlotte, NC: Information Age Publishing.

Garvin, M., Neary, M., & desJardins, M. (2019). State case study of computing education governance. *ACM Transactions in Computing Education*.

Garvin, M., Killen, H., Plane, J. & Weintrop, D. (2019). Primary school teachers' conceptions of computational thinking. In *Proceedings of the 50th ACM Technical Symposium on Computer Science Education (SIGCSE'19)*. ACM.

Killen, H., Garvin, M., & Weintrop, D. (2019). AP Computer Science Principles' impact on the landscape of high school computer science using Maryland as a model. In *Proceedings of the 50th ACM Technical Symposium on Computer Science Education (SIGCSE'19)*. ACM.

MD Computing Education Governance

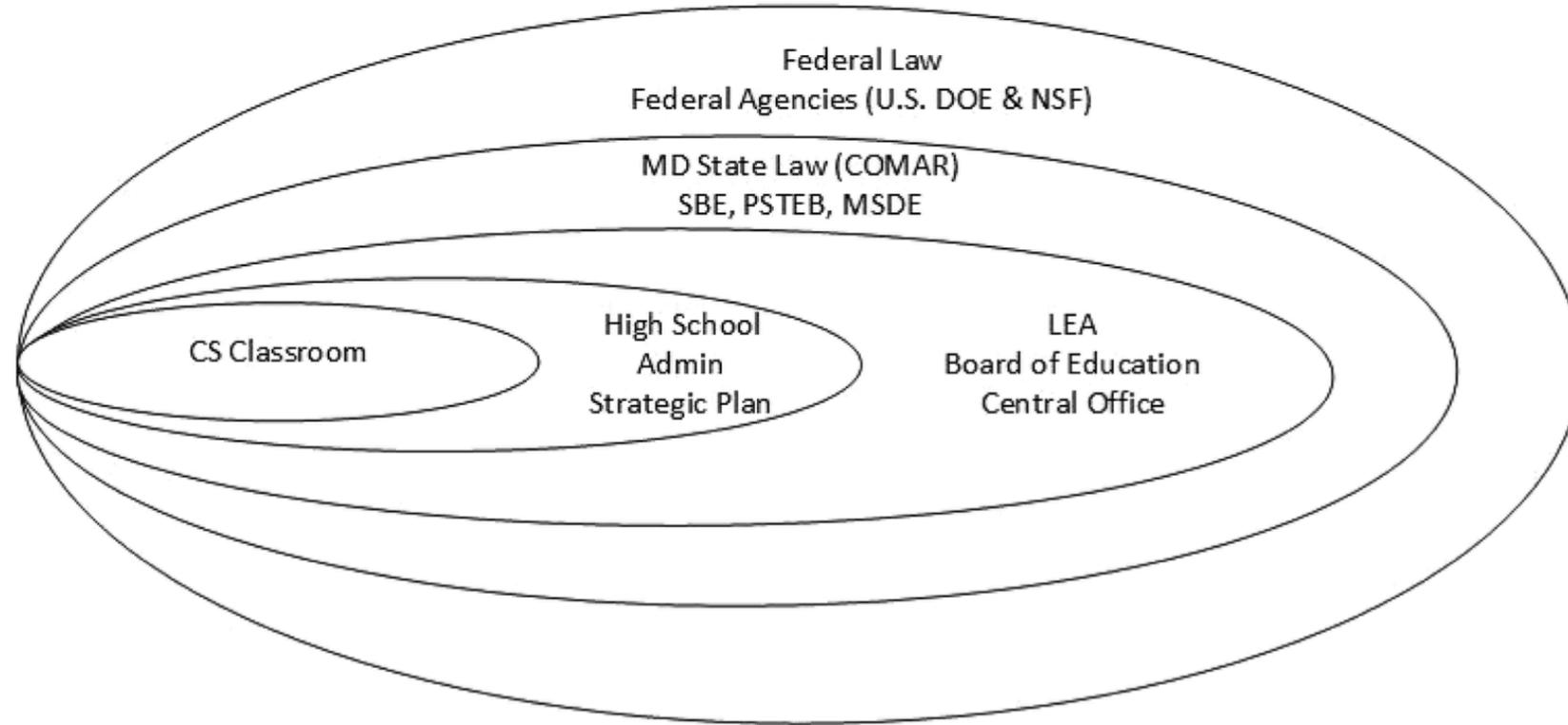


Fig. 1. Embedded multi-level case study to analyze high school computing education reform by analyzing each governance level.



MD Computing Education Governance

How have the state governance structures at each level impacted computing education reform efforts from 2010 through 2016?

- How has understanding autonomy and accountability at each governance level broadened participation for public high school students?
- What are the successes and persistent barriers to democratizing computing education at each governance level?



MD Computing Education Governance

Data

- Maryland Computing Education Landscape Surveys
 - ❖ 2012, 2014, 2016
- MLDSC external data requests
- Maryland Computing Education Summit
 - ❖ 2016



MD Computing Education Governance

Federal Laws and Initiatives

- Every Student Succeeds Act (ESSA) 2015
- Individuals with Disabilities Education Act (IDEA)
- Family Educational Rights and Privacy Act (FERPA)
- Funding



MD Computing Education Governance

State Level

- Maryland State Board of Education (MSBE)
- Professional Standards and Teacher Education Advisory Board (PSTEB)
- Maryland State Department of Education (MSDE)

Maryland Public High School Graduates Who Took at Least 1 CS Class by Gender and Race/Ethnicity

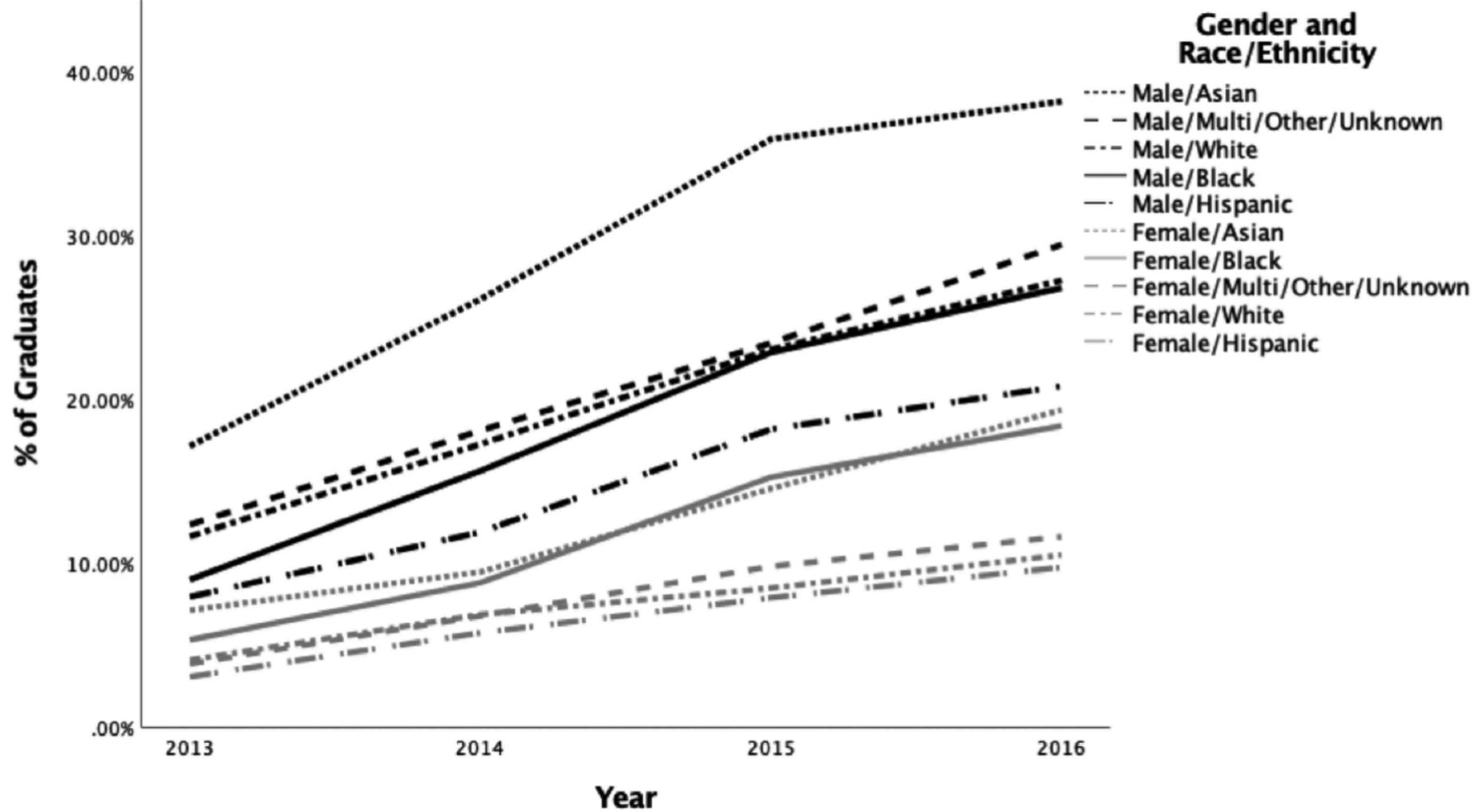


Fig. 2. The percentage of public high school graduates from 2013 through 2016 who took at least one CS class by the intersection of gender and race/ethnicity.

Maryland Public High School Graduates Who Took at Least 1 CS Class

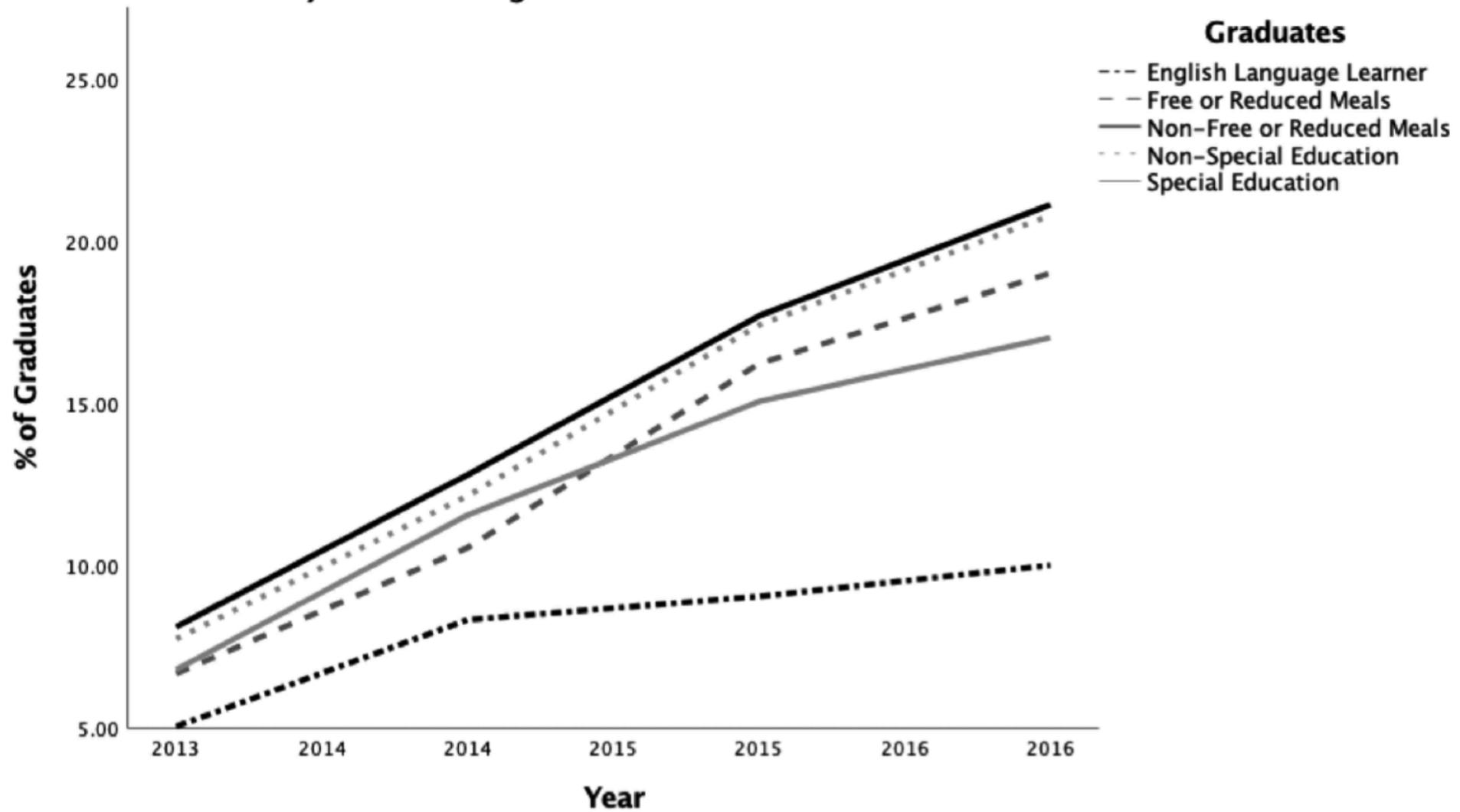


Fig. 3. The percentage of Maryland public high school graduates from 2013 through 2016 who took at least one CS class by socioeconomic status, disability status, and English language learners.

MLDSC Data

Maryland Public High School CTE Graduates and Freshman College Major (2012-2015)

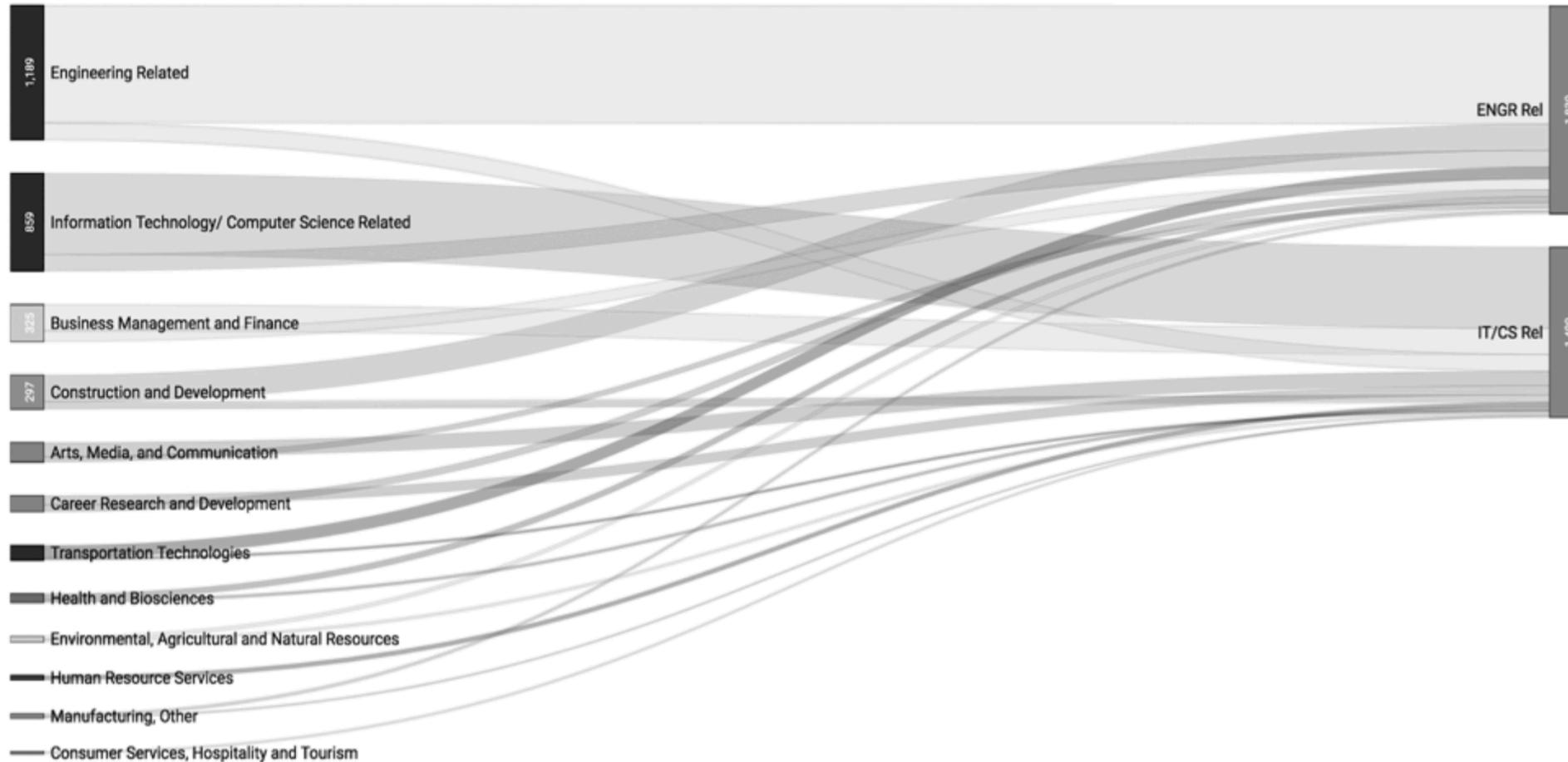


Fig. 4. This Sankey diagram shows the path of Maryland public high school CTE graduates (2012–2015) who continued to college and majored in either engineering or information technology/computer science–related majors.

Maryland Public High School Graduates who Took AP CSA

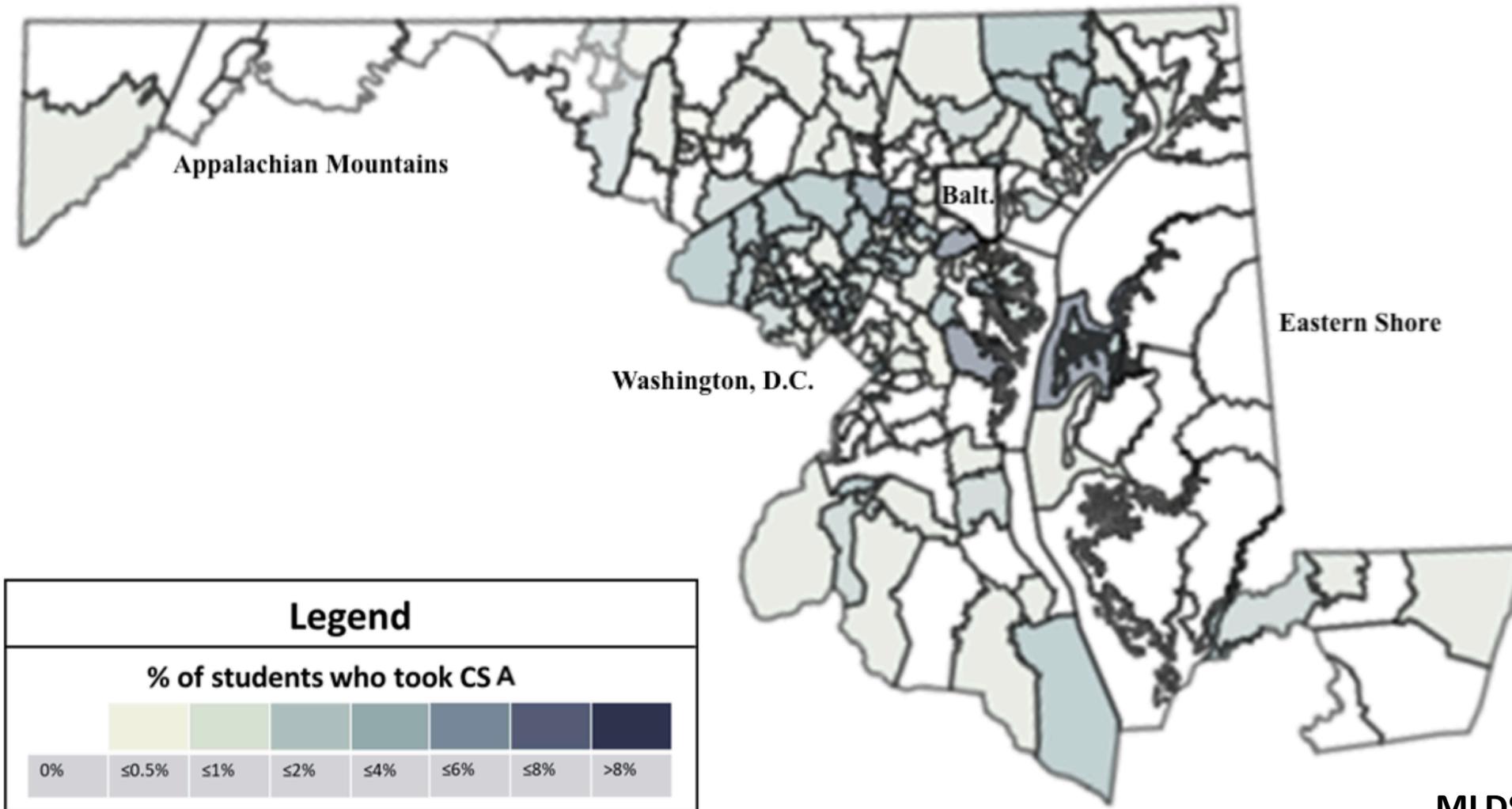


Fig. 5. The percentages of public high school graduates (2013–2016) who took AP CSA per Maryland public high school. The map boundaries indicate the public high school boundary for each public high school.



MD Computing Education Governance

Local Education Agency Level

- System Central Administration Office
- School
- Classroom
 - Teacher
 - Student

School Barriers Indicated by MD Public High School Teachers

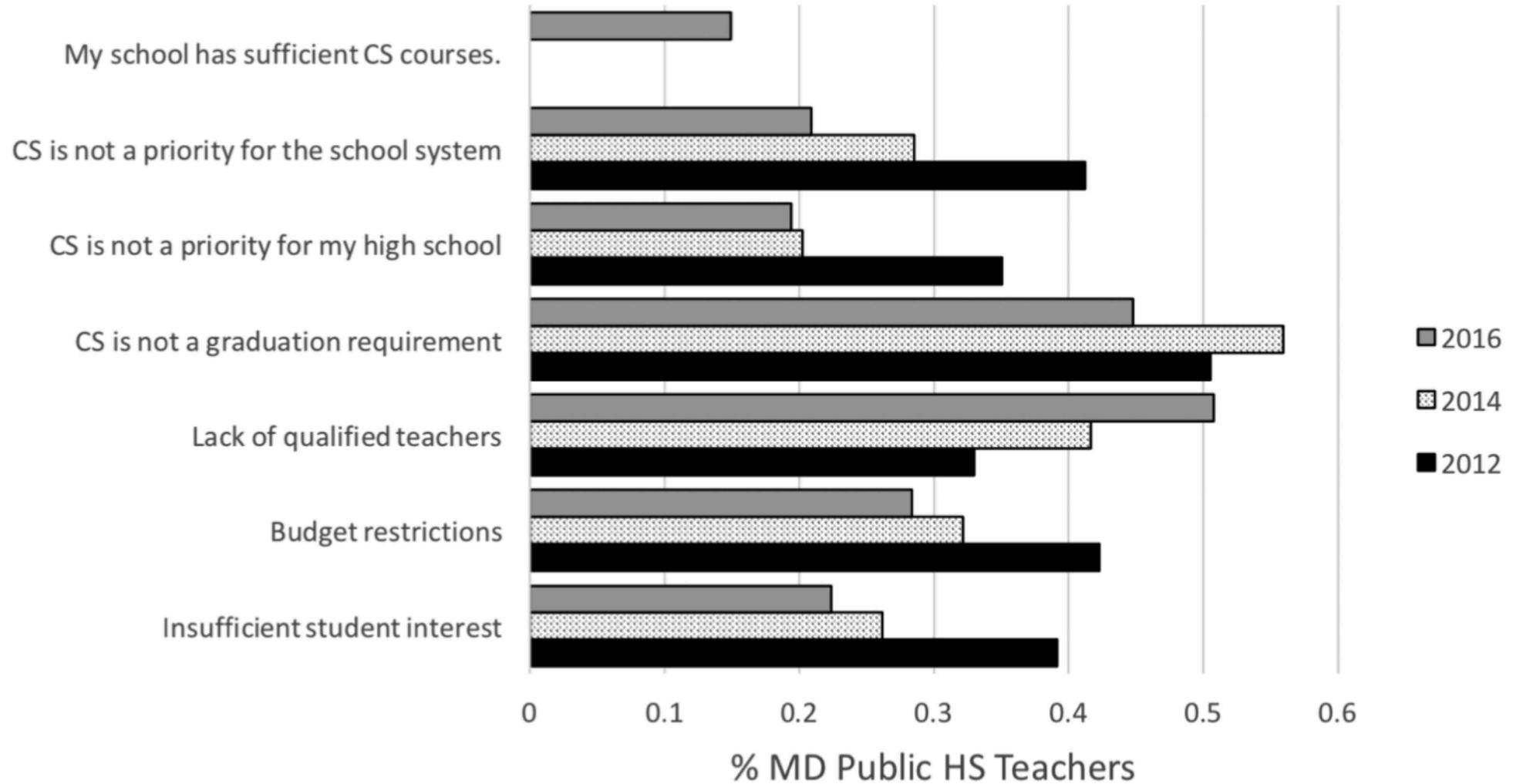


Fig. 6. Public high school teachers landscape survey (2012, 2014, 2016) results regarding school barriers.

Student Barriers Indicated by MD Public High School Teachers

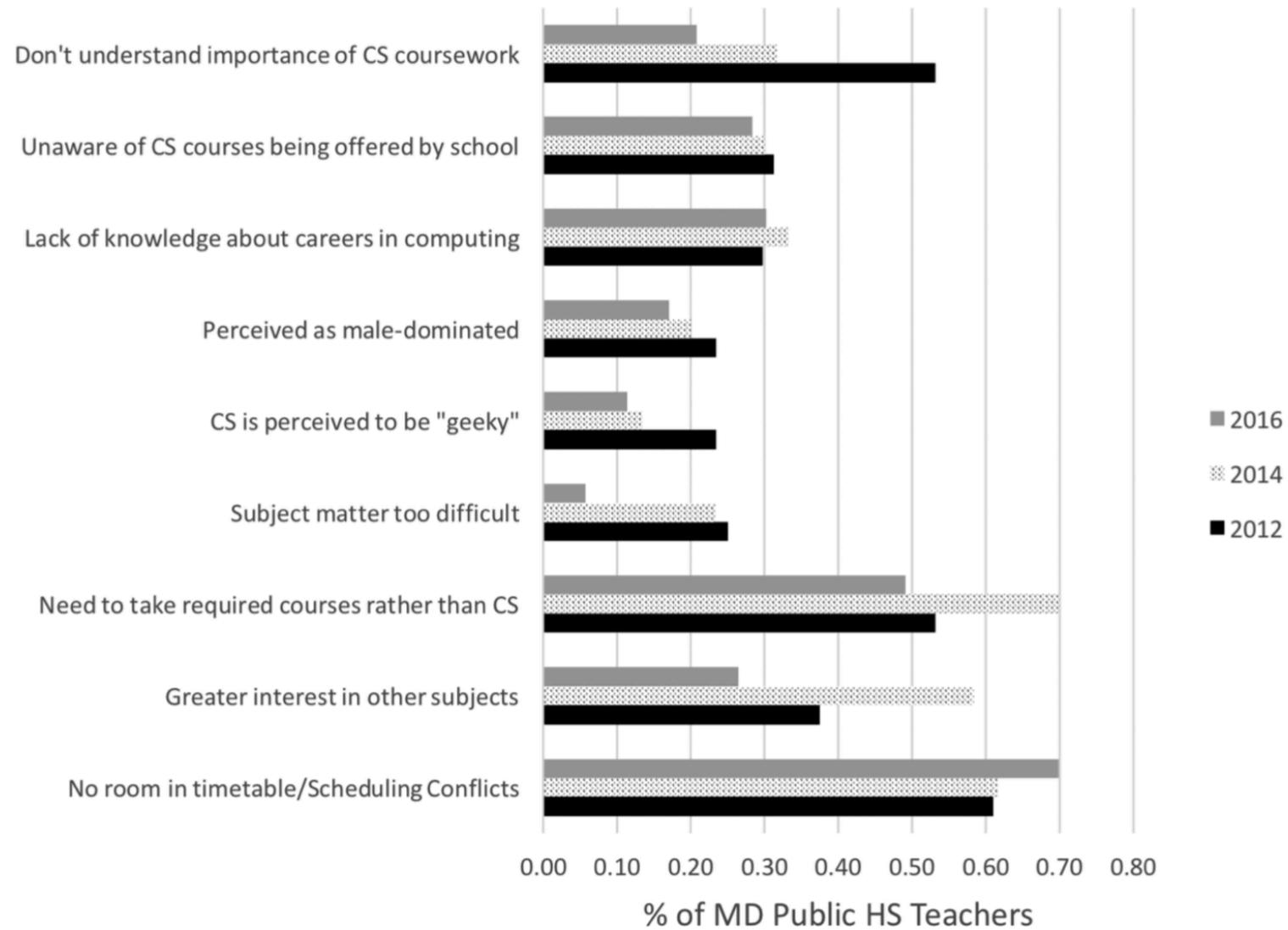


Fig. 7. Public high school teachers landscape survey (2012, 2014, 2016) results regarding teacher perceptions of student barriers.



MD Computing Education Governance

Data Limitations

- K-12 CS courses inconsistently reported
- Higher Ed course through data
- Workforce job titles
- Survey return rates



MD Computing Education Governance

- **Computer Science: A Content Discipline**
- **Teacher Pipeline**
- **Broadening Participation in Computing**



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Proposed Public Data Report

College and Workforce Participation and Alignment of Maryland High School Graduates Who Completed at Least One Computing Education Course.

Core Population

- ❖ Maryland public high school graduates who completed at least one computing education course during their high school experience.



Proposed Public Data Report

Key Metrics

1. Number of graduates who enrolled in college in the fall following graduation (possibly within one year).
2. Number of college-going students who persisted in college into the fall of the second year.
3. Number of college-going students with an initial computing related major.
4. Number of non-college-going students who entered the workforce (possible inclusion of NAIC alignment depending on data review)